

石 油 学 报

(石油加工)

第 38 卷 第 3 期 2022 年 5 月

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信息

《石油学报(石油加工)》征订启事(662); 关于《石油学报(石油加工)》网上投稿的特别声明(670); 《China Petroleum Processing and Petrochemical Technology》征订启事(677); 《石油炼制与化工》征订启事(717); Ei 对中英文摘要的要求(744)

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(PETROLEUM PROCESSING SECTION)

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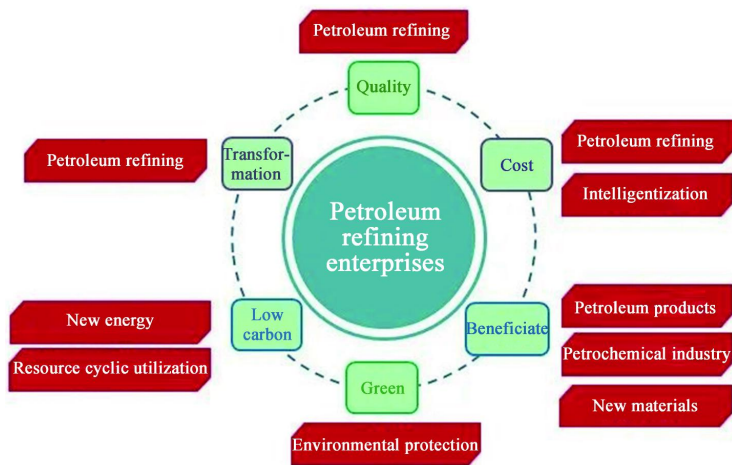
Special Articles

Acta Petrolei Sinica (Petroleum Processing Section), 2022, 38(3): 0493-0499 doi: 10.3969/j.issn.1001-8719.2022.03.001

High-Quality Development Path for Refining and Chemical Enterprises Under the Dual Carbon Background

LI Mingfeng WU Hao SHEN Yu CHU Yang
YU Bo

This paper proposes the development plan for oil refining industry under the dual orientation of dual carbon and market, including key technologies of oil refining under the improvement of quality targets and those under the continuous improvement of environmental protection objectives, as well as technologies of oil refining structure transformation, continuous energy conservation and carbon reduction, and cost reduction.

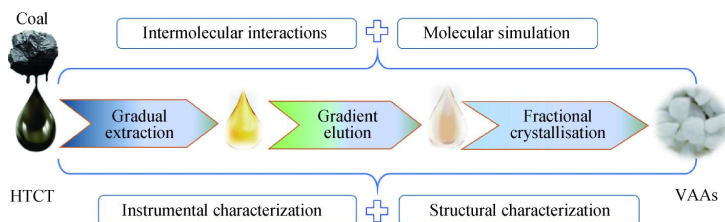


Acta Petrolei Sinica (Petroleum Processing Section), 2022, 38(3): 0500-0511 doi: 10.3969/j.issn.1001-8719.2022.03.002

Basic Research and Technology Development for the Separation of Condensed Aromatics From High-Temperature Coal Tar

WEI Xianyong ZONG Zhimin ZHAO Wei NI Zhonghai CAO Jingpei FAN Xing ZHAO Yunpeng LIU Ziwu
PENG Yaoli LIANG Jing ZHAO Xiaoyan TAO Xueyu KANG Yuhong MO Wenlong CONG Xingshun WANG Yugao
LIU Zhongqiu LIU Guanghui GUO Xianhou MA Zhihao GAO Huashuai LI Jiahao CHEN Yifeng YAN Weiwei
YIN Fan JIANG Zhijie YU Xinke

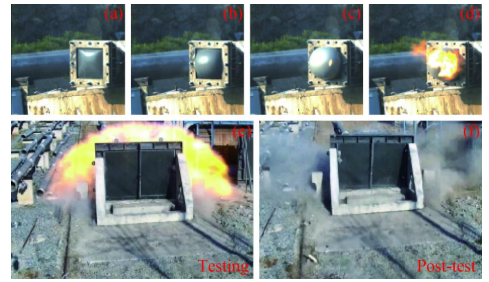
High-temperature coal tar (HTCT) is an important raw material for obtaining value-added aromatics (VAAs). Considering the problems of high energy consumption and poor separation effect encountered by traditional separation process, the research team has developed a stepwise technology for separating VAAs from HTCT through gradual extraction, gradient elution and fractional crystallisation.



Application of Blast-Mitigation HSE Materials in the Petrochemical Industries

YANG Zhe YANG Ke CHENG Qingli WANG Quanguo

A novel flame-retardant and blast-mitigation polyurea material was introduced. Through adding flame-retardant polyester polyols, the polyurea could meet combustion class B and has good mechanical property with 27 MPa tensile strength and 320% elongation. In the gas explosion test, the polyurea coating could resist 1.16 MPa explosion overpressure.

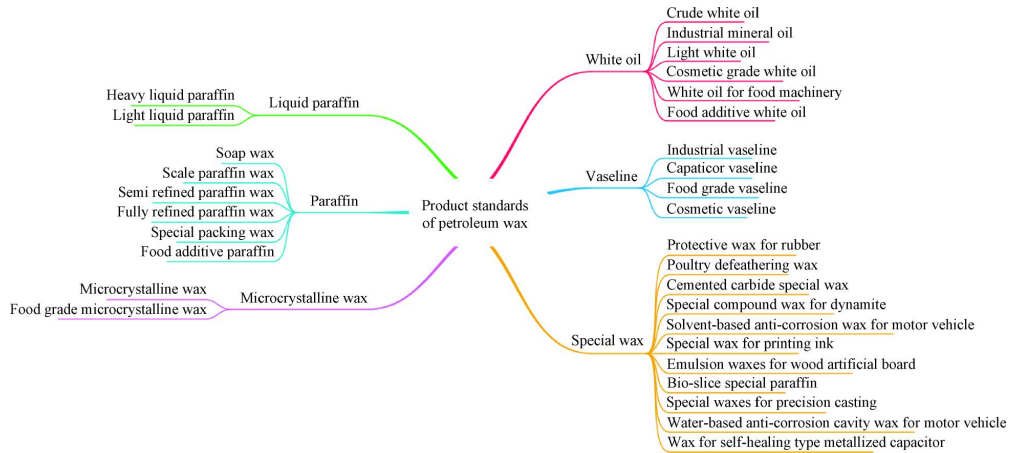


(a) The first-stage photo of gas explosion test ;
 (b) The second-stage photo of gas explosion test ;
 (c) The third-stage photo of gas explosion test ;
 (d) The fourth-stage photo of gas explosion test ;
 (e) The photo of gas explosion testing concrete wall with BMFRPUA ;
 (f) The photo of gas explosion post-test concrete wall with BMFRPUA ;
 BMFRPUA—Blast-mitigation and flame-retardant polyurea

Status Quo and Development Trend of Petroleum Wax Product Standards

WANG Shiyu LING Fengxiang WANG Shaojun

The status quo of standard construction of petroleum wax in China was sorted out, and the development trend of petroleum wax standards was discussed. The standard quality level should be improved for the development of the China's petroleum wax industry.

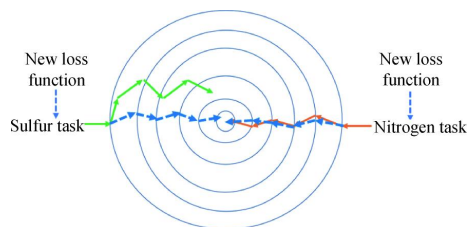


Acta Petrolei Sinica (Petroleum Processing Section), 2022, 38(3): 0528-0534 doi: 10.3969/j.issn.1001-8719.2022.03.005

A New Loss Function in Multitasking Prediction Optimization Model and Its Application in Catalyst Evaluation for Wax Oil Hydrogenation

TIAN Wang QIN Kang LI Mingfeng HU Yuanchong
LIANG Jialin CHU Xiaoli

A new loss function was constructed to balance the gradient of sulfur and nitrogen tasks in the model training process, and the problem of the neural network model in simultaneously predicting sulfur and nitrogen contents in refined wax oil was solved.

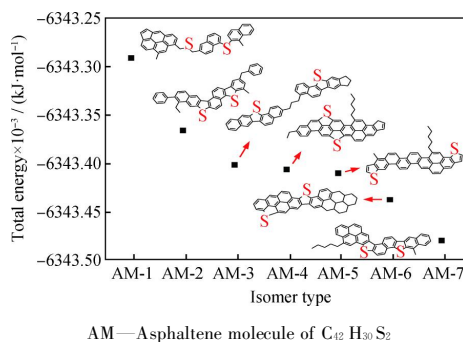


Acta Petrolei Sinica (Petroleum Processing Section), 2022, 38(3): 0535-0543 doi: 10.3969/j.issn.1001-8719.2022.03.006

Exploration of the Molecular Structure Basis for Weight-Reduction Conversion of Asphaltene Fractions

CAI Xinheng DONG Ming HOU Huandi WANG Wei LI Jiguang
ZHANG Zhihua REN Qiang LONG Jun

Asphaltene molecules with bridge bonds or internal heterocycles (Archipelago type I, archipelago type II, and island type I) are easily and greatly reduced the number of aromatic rings through the cleavage of bridge bond or hydrogenolysis of heterocycles, which reduces the boiling point and aggregation activity significantly, therefore, it achieves weight-reduction conversion of residue and asphaltenes at low consumption of hydrogen.

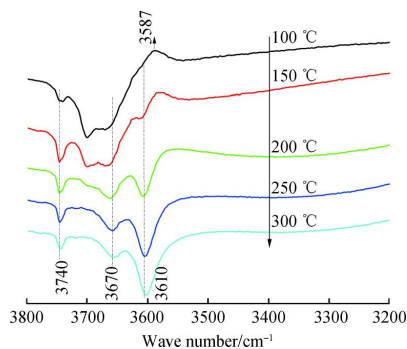


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In-Situ Infrared Spectrum Study on the Catalytic Reaction Mechanism of Methanol and Light Hydrocarbon

GE Xiang WU Shiyong ZHAO Jigang CHENG Xitong
SHEN Benxian

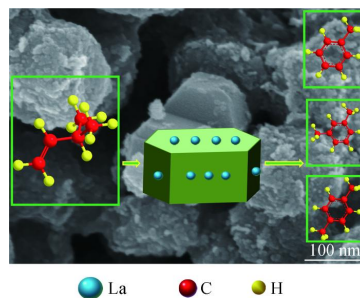
When the temperature is below 150 °C, the infrared stretching vibration peak of hydrogen-bond associated with methanol appears at 3587 cm⁻¹, which confirms the adsorption of methanol on zeolite during mixed feeding. As the temperature rises from 150 °C to 200 °C, the peak intensity of the infrared absorption of hydrogen-bond associated hydroxyl radical (3587 cm⁻¹) disappears, but the characteristic peak of dimethyl ether does not appear, indicating that the presence of *n*-hexane changes the reaction pathway of methanol.



Effect of La/ZSM-5 Zeolites With Different SiO₂/Al₂O₃ Ratios on the Isomerization/Aromatization Performance of FCC Light Gasoline

SONG Shaotong LI Tianshu JU Ya'na LI Yang WU Pei SUN Changyu DUAN Aijun

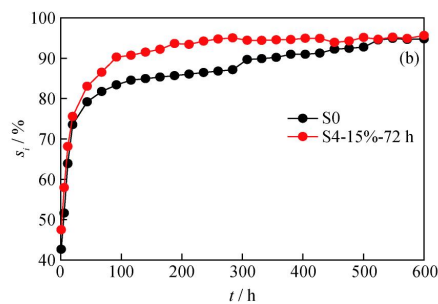
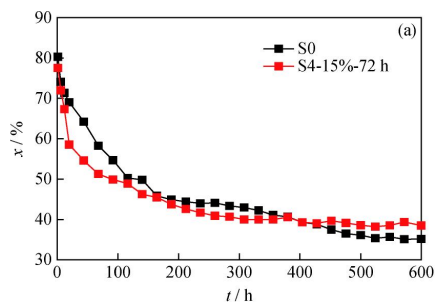
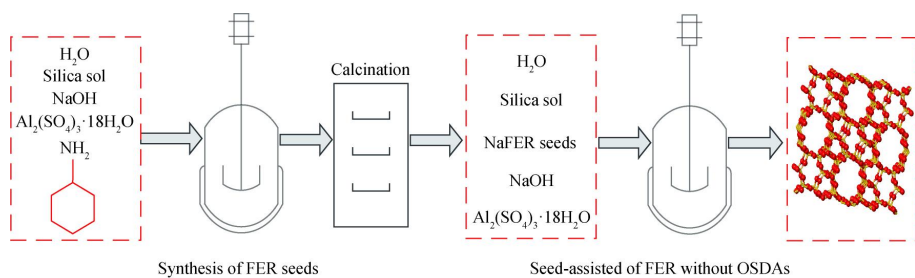
The La/ZSM-5-200 catalyst with regular hexagonal morphology exhibits good olefin isomerization and aromatization, as well as octane number recovery activities. C₆+ olefins, as the most abundant species in the FCC light gasoline, can be cyclized to produce C₇—C₉ aromatics through polymerization, cyclization and dehydrogenation reactions under the catalyst action of La/ZSM-5-200.



Skeletal Isomerization of 1-Butene Catalyzed by Seed Crystal-Induced Synthesis of FER Zeolite

FAN Jinlong XU Yarong CHEN Lantian GONG Tao XU Lei ZHU Xuedong

The addition amount of seed crystal and the crystallization time were investigated for the OSDA-free synthesis of FER zeolite by hydrothermal synthesis with the aid of NaFER seed crystal prepared using cyclohexylamine (CHA), and the seed crystal-assisted FER zeolite has higher catalytic activity and stability for skeletal isomerization of 1-butene to isobutene.



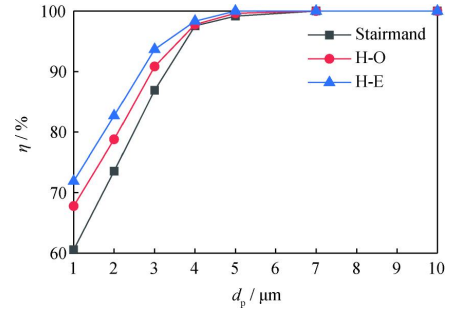
x_t —1-Butene conversion; s_t —*iso*-Butene selectivity

Reaction conditions: $T=350\text{ }^\circ\text{C}$; $p=0.1\text{ MPa}$; $MHSV_{1\text{-butene}}=2\text{ h}^{-1}$

Cyclone Separator Flow Field Control Through Outer Diversion Tube

XIE Kai WANG Juan ZOU Shuo WANG Jiangyun MAO Yu

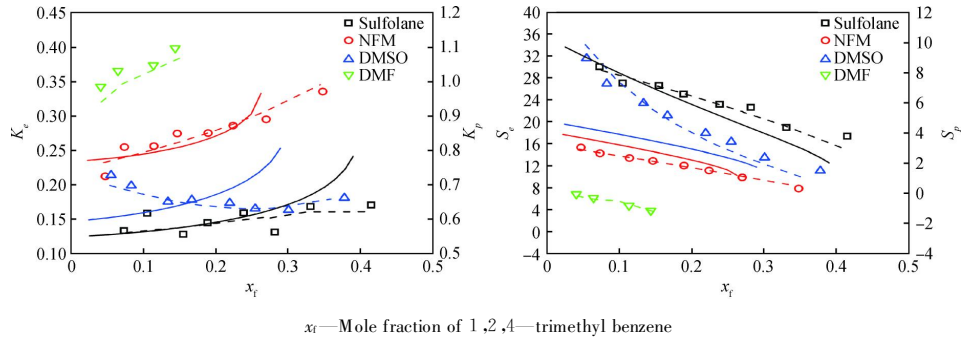
Numerical calculation results show that diversion tube can improve secondary vortex distribution in the cyclone separator, reduce impact range of longitudinal circulation, mitigate synergistic effects between secondary vortices, and restrain secondary flow at the entrance of ash hopper and the inlet of dipleg. All of the above effects can help improve separation efficiency. Cyclone with a diversion tube has a better capability to capture small size particles, and H-E cyclone has the best separation efficiency. This work can provide guidance for industrial cyclone separation practice.



Separation Performance of Extracting Unsym-Trimethyl Benzene in Diesel With Four Organic Extractants

DING Yan SUN Yuhang CHEN Daoqi ZHAO Deming LI Jinlong

At the same temperature, the molar partition coefficients of different extractants for unsym-trimethyl benzene are listed in a descending order as follows: DMF > NFM > DMSO > sulfolane, and the molar selectivities are as follows: Sulfolane > DMSO > NFM > DMF.

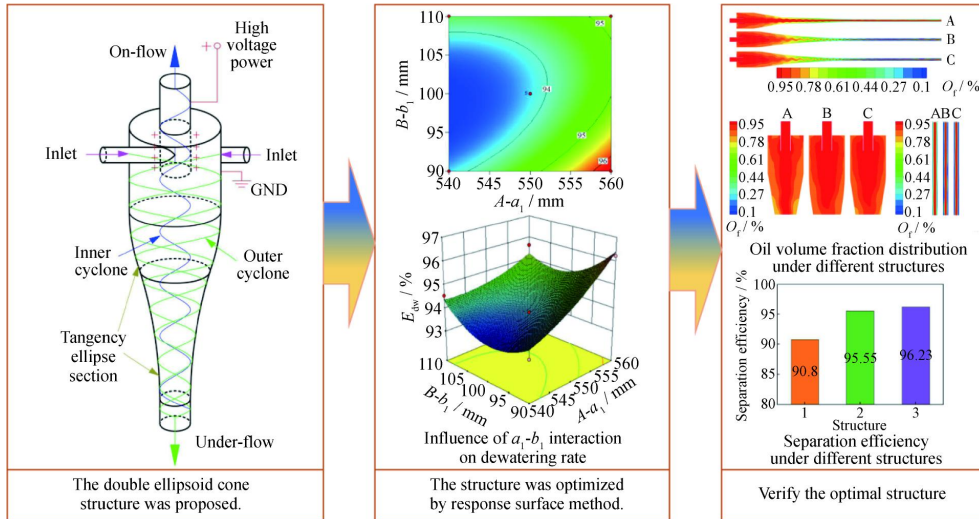


Partition coefficient (K_p, K_p) and selectivity coefficient (S_p, S_p) of unsym-trimethyl benzene in four extractants at 323.15 K

Separation Characteristics and Structure Optimization of Double Ellipsoid Cone Double -Field Coupling Demulsifier

GONG Haifeng QIU Zhi PENG Ye YU Bao LIAO Zhixiang CHEN Ling YANG Yang

A double-field coupling device with double elliptic tangential cones was proposed . The parameters were optimized by response surface method , and the results were compared and verified by ANSYS Fluent software .



A and B are a and b coded referential symbols respectively . a and b are the major and minor axes of ellipse 1 respectively , mm .

E_{dew} —The dewatering rate , % ; 1—Straight double-cone structure ; 2—Non optimized double-ellipse tangent cone structure ;

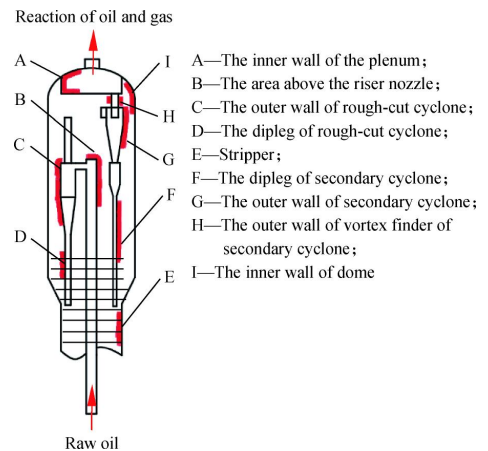
3—Optimized double-ellipse tangent cone structure ; O_t —The oil volume fraction , %

Research Progress on Coking in FCC Disengager

WANG Juan YU Haiyan XIE Kai XU Haohan

WANG Zhuang WANG Jiangyun MAO Yu

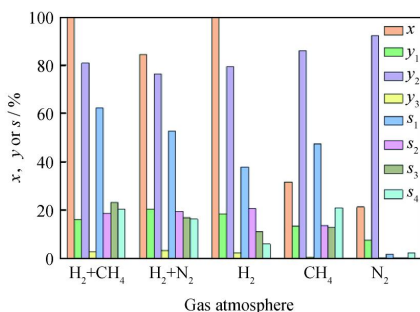
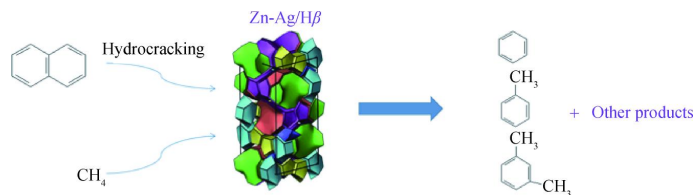
The basic characteristics of the coking material , coking causes , coking mechanism and influencing factors were analyzed , so as to optimize the development of a new structure that slows down or inhibits the coking process of the disengager and reduce the harm of coking to the stable and long-term operation of the device .



Promotion by Methane on the Hydrocracking Reaction of Polycyclic Aromatic Hydrocarbon

SHEN Zhibing REN Zhaoyang FU Rao TANG Ruiyuan LIANG Shengrong ZHANG Juntao CHEN Yifan

Methane was introduced into the naphthalene hydrocracking reaction over Zn-Ag/H β catalyst. Methane can be activated and participate in the reaction, which can improve the selectivity of toluene and xylene, and achieve high liquid phase yield and low carbon deposition yield. Mixed atmospheres of methane and hydrogen are significantly better than other gas atmosphere.



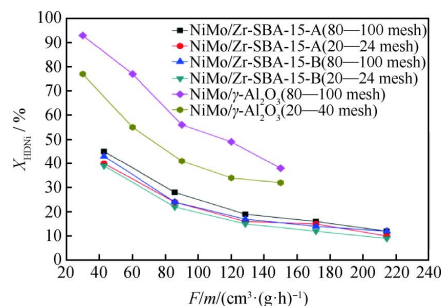
x—Conversion of naphthalene; y₁—Yield of gas; y₂—Yield of liquid; y₃—Yield of coke;

s₁—Selectivity of BTX; s₂—Selectivity of benzene; s₃—Selectivity of toluene; s₄—Selectivity of xylenes

Hydrogenation Reaction and Diffusion Behavior of Nickel-Porphyrins

CHEN Zhentao JIANG Tao YANG Haoxuan YU Jiahuan
ZHAO Yang LIU Yaxin ZHAO Fangyu XU Chunming

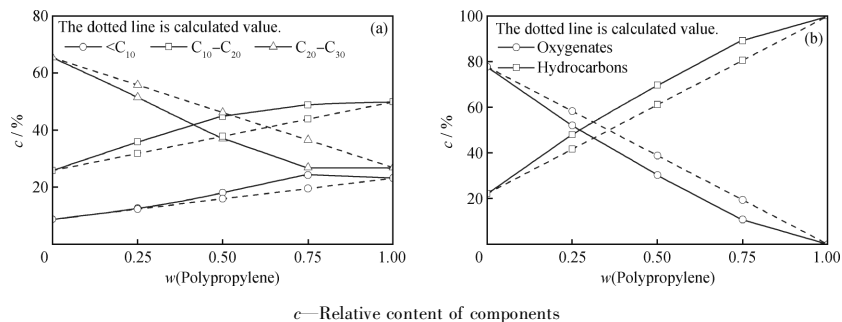
The conversion rate of Ni-TPP over NiMo/ γ -Al₂O₃ catalyst is higher than that over NiMo/Zr-SBA-15 catalysts. The pore size has a significant effect on Ni removal under the action of the former catalyst, but has little effect on that under the action of the latter catalysts, indicating a stronger influence on intraparticle diffusion in NiMo/ γ -Al₂O₃ catalyst.



Co-Pyrolysis Characteristics and Product Distribution of Mixed Steel Rolling Oil Sludge and Polypropylene

WANG Jianglin LIN Shunhong YANG Yu BAI Jisong GUO Daijiang CHEN Ye

There was an interaction between the steel rolling oil sludge and polypropylene co-pyrolysis, the relative content of heavy components and oxygen-containing components in the liquid product were reduced. When the mass fraction of the polypropylene was 0.75, comparing the experimental value with theoretical one, the relative content of C₂₀—C₃₀ components in the liquid phase product was reduced by 9.68 percentage, and the relative content of oxygen-containing components was reduced by 8.60 percentage.

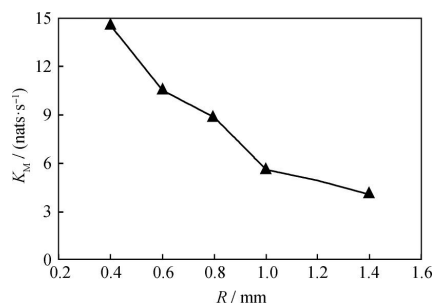


(a) Components with different carbon numbers; (b) Oxygenates and hydrocarbons

Dynamic Characteristics of Droplets in Oil Excited by Chaotic Pulse Width Modulation Electric Field

PENG Ye ZHANG Youyu GONG Haifeng LIAO Zhixiang
QIU Zhi YU Bao

The vibration of droplets in chaotic pulse width modulation electric field has chaotic characteristics, and the degree of chaos decreases with the increase of particle size.



K_M —Maximum likelihood estimation of kolmogorov entropy;

R —Radius of spherical droplets

Conditions: $\rho^0 = 1000 \text{ kg/m}^3$; $\mu^0 = 47.2 \text{ mPa} \cdot \text{s}$; $\epsilon = 5$;

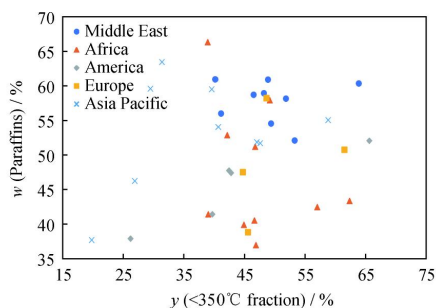
$\gamma = 12 \text{ mN/m}$; $E = 3 \times 10^{-5} \text{ V/m}$

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Optimization of Crude Oil Suitable for Producing Bulk Petrochemical Materials

WANG Xiaowei ZHANG Qundan TIAN Songbai

According to the distribution of $<350\text{ }^{\circ}\text{C}$ fraction yield and paraffin content of crude oils in different regions, it is found that crude oils from the Middle East are ideal feedstocks for direct cracking process to produce ethylene.

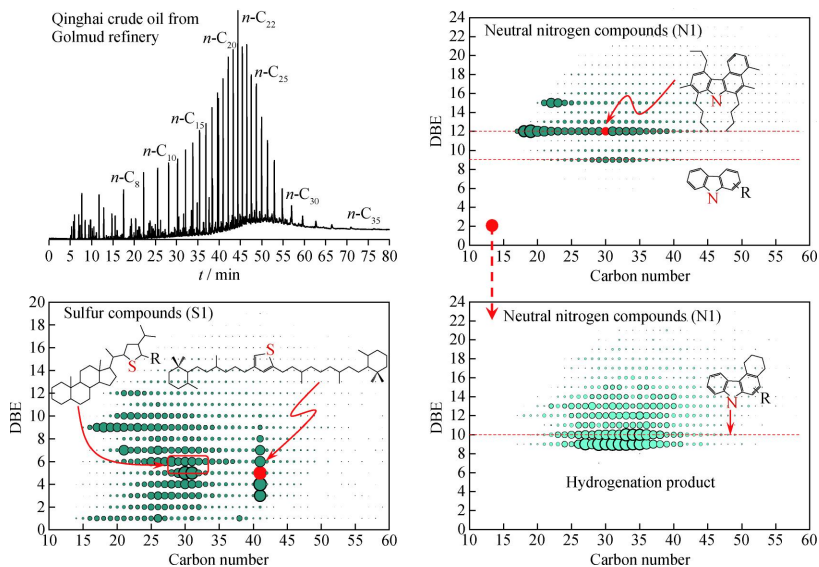


Acta Petrolei Sinica (Petroleum Processing Section), 2022, 38(3): 0671-0677 doi: 10.3969/j.issn.1001-8719.2022.03.019

Molecular Composition Characteristics of Qinghai Crude Oil and Hydrogenation Conversion Law of Nitrogen-Containing Compounds in Its Atmospheric Residue

ZHANG Yahe ZHAO Yusheng ZHAO Yuansheng YU Shuanglin YAO Yuan CHEN Jialing LI Haidong HUO Da LI Han SHI Quan

Qinghai crude oil from Golmud refinery and its distillation residue have special compositional characteristics, making it different from other oils. Sulfides and thiophenes instead of benzo- and dibenzo- thiophenes are the dominant sulfur species in the oil. Nitrogen-containing compounds are refractory for hydrotreating due to the steric hindrance effect. (N1 and S1 refer to heteroatom compound classes in the oil with one nitrogen atom and one sulfur atom, respectively)

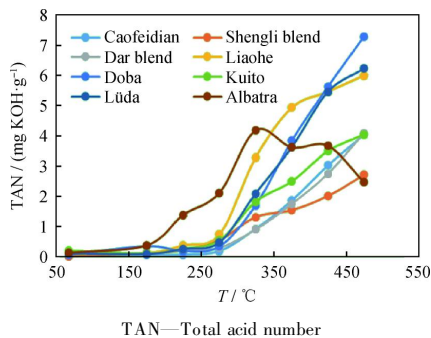


DBE—Double bond equivalent

Rapid Distillation Method and Its Application in the Study of the Distribution Law of the Total Acid Number of Crude Oil

TIAN Songbai ZHANG Qundan LIN Yugui WANG Xiaowei
LIU Yingrong

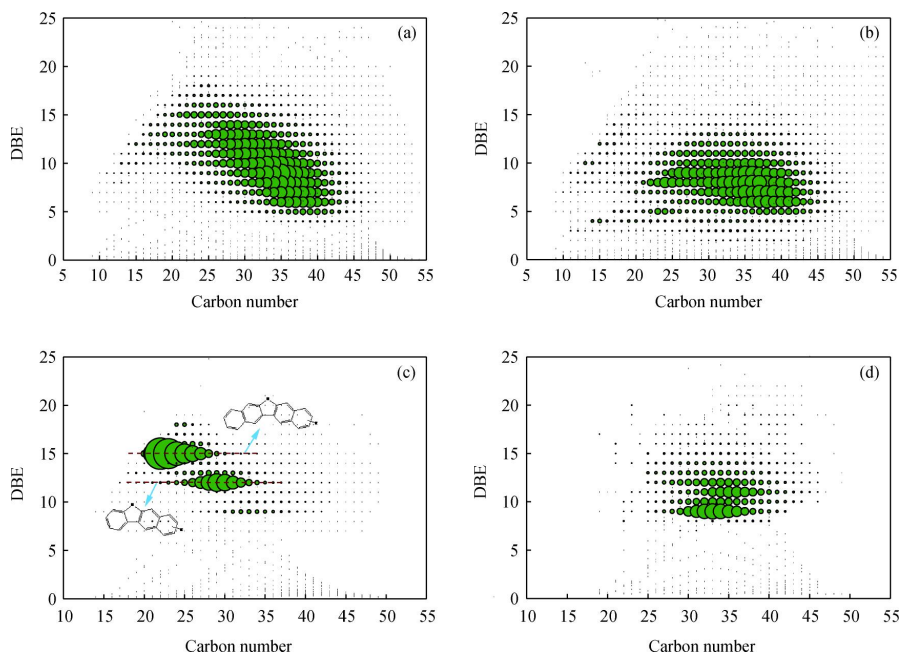
To avoid the decomposition losses of petroleum acids, a rapid distillation apparatus for crude oil was developed using short fractional column, high vacuum degree and high distilling rate. As a result, a recovery rate of >90% of the TAN is obtained and the TAN distribution basically increases with the increasing of boiling point.



Characterization of Changes in Nitrogen Compounds in Vacuum Gas Oil During Hydrodenitration by Ion Mobility Time-of-Flight Mass Spectrometry

GAO Huihui CAO Qing XIU Yuan WANG Yanfei SHI Dejun

Nitrogen compounds in Daqing vacuum gas oil (VGO) and its hydrotreated products were characterized by Ion Mobility Time-of-Flight Mass Spectrometry (IMS-TOF MS) equipped with electrospray ionization (ESI). The results demonstrate that in untreated VGO, benzocarbazole and dibenzocarbazole compounds are dominant in the neutral nitrogen compounds, which are firstly saturated and converted into cyclic amines, and then removed by further hydrogenation.



The size of the bubbles represents the relative abundance of the corresponding mass spectral peaks for N1 class compounds.

DBE—Double bond equivalent number of N1 class species

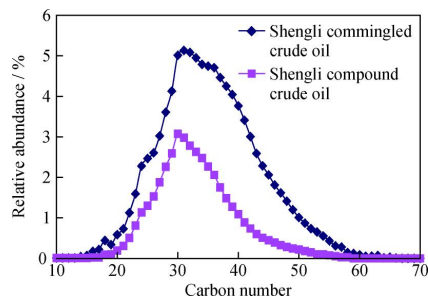
(a) Daqing VGO and (b) the mildly hydrotreated sample from positive-ion ESI IMS-TOF mass spectra;

(c) Daqing VGO and (d) the mildly hydrotreated sample from negative-ion ESI IMS-TOF mass spectra

Effect of True Boiling Point Distillation on the Corrosivity of Two Kinds of High -Acid Crude Oils and Its Characterization

ZHANG Qundan TIAN Songbai LIN Yugui LIU Yingrong

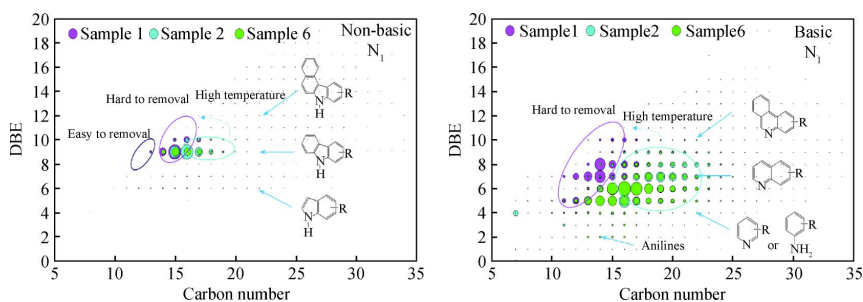
Macro-molecular petroleum acid was decomposed into small-molecular petroleum acid after true boiling point distillation of crude oils. The decomposed small-molecular petroleum acid is more corrosive. The types of petroleum acids remain little changed, but the carbon number distribution shows an obvious change, suggesting that the higher the carbon number, the greater the decomposition rate of macro-molecular petroleum acid.



Composition Distribution of Nitrogen Compounds in Coking Diesel and Their Molecular Selectivity in the Hydrogenation Process

SUN Jin ZHANG Yahe GUO Rong LI Shuofan LI Yang LI Han SHI Quan

Double bond equivalent (DBE) and carbon number distribution diagrams of N₁ class non-basic and basic nitrogen compounds in the hydrogenated products of diesel at different hydrogenation temperatures.

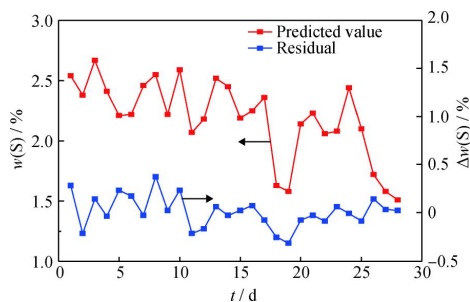


Hydrogenation temperature of sample 1, 2, 6 are fiducial temperature +10 °C, fiducial temperature, fiducial temperature -40 °C.

Development and Application of Web-Based Near Infrared Crude Oil Fast-Evaluation Technology

LI Jingyan CHU Xiaoli LIU Dan DONG Lijun FENG Baojie XU Yupeng CHEN Pu

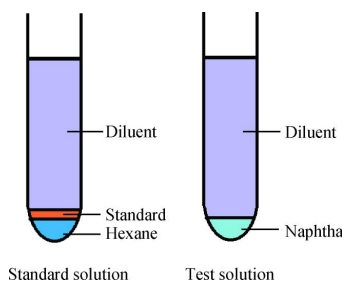
Web-based crude oil fast-evaluation software was developed. The software has centralized system for maintenance and release of model database, management of spectral database and evaluation database, and upgrading the algorithm of crude oil fast evaluation. Through comprehensive application of the upgraded algorithm, calculation speed and recognition accuracy of prediction results were significantly improved.



Determination of Trace Elements in Naphtha by Inductively Coupled Plasma Mass Spectrometry

WANG Ke

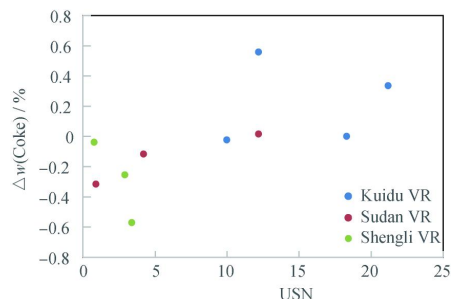
The content of trace elements in naphtha was determined by organic direct injection-inductively coupled plasma mass spectrometry. To reduce matrix interference, the naphtha was diluted 10 times using commercial diluent, and the standard solution was prepared with the commercial diluent containing 10% hexane.



Method for Stability Assessment of Wax Oil and Slag Mixing System Based on Multiple Light Scattering

GUAN Xiupeng TIAN Songbai

The relationship between USN and raw coke mass fraction in the wax oil and Kuidu/Sudan/Shengli oil mixing system was analyzed. It is found that when the USN index is greater than 10, the raw coke mass fraction increases significantly, indicating that there is a certain influence relationship between USN and raw coke mass fraction.

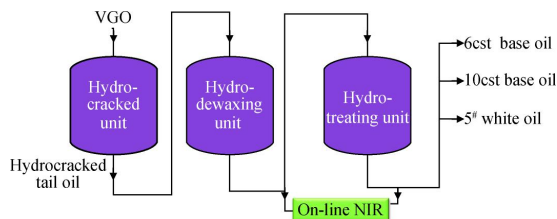


USN—Unstability number; VR—Vacuum residue oil

Application of On-Line NIR Technology in Lubricating Oil Hydroisomerization Unit

XU Yupeng LIU Dan CHU Xiaoli ZHANG Qundan CHEN Pu WU Mei

Based on the configuration of on-line NIR analysis system and application of the established multi-property near-infrared analysis models, on-line NIR technology was applied in lubricating oil hydroisomerization unit to perform real-time analysis of distillation range, viscosity, viscosity index and pour point of hydrocracked tail oil and base oil.



Application of Microfluidic Imager in the Analysis of Particles and Insoluble Substances in Oils

SHI Junge ZHENG Junlin YANG Mengzhi LIN Yugui

The analytical method of particles and insoluble substances in different types of oils was established using microfluidic imager. Compared with the traditional method for testing insoluble substances, this method is simple, fast, accurate and can provide a large amount of information.

